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# The Effect of Yoga on Attention in Students Diagnosed with ADHD

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# The Effect of Yoga on Attention in Students Diagnosed with ADHD

Andrew Petsche, PhD

University of Connecticut, 2016

ADHD impacts approximately 5% of children and has substantial negative effects on school behaviors, particularly with regard to attention. A number of school-based interventions exist to address the attention and focusing abilities of individuals diagnosed with ADHD; however, all of the existing interventions feature drawbacks such as expense, inefficient uses of time and resources, or negative side effects. Yoga has been shown to be a viable alternative to the traditional treatment methods for ADHD, particularly with regard to improving the attention and concentration levels of students. The present study utilized the Yoga Fitness for Kids videotape as an intervention for four, second grade boys who were diagnosed with ADHD and on a regular medication regimen for the disorder. The researchers used direct observation methods to examine whether the intervention would effectively increase the percentage of intervals on-task for the students. The results of the study showed that the percentage of intervals on-task was improved from the baseline to intervention phase for three of the four participants, while one participant demonstrated non-significant improvements in behavior. The Tau-U statistic was calculated to measure the effect size of the intervention for each participant, and scores ranged from 0.60 to 1.00. The weighted average Tau-U score across participants was 0.79. These results suggest that yoga can be utilized as a school-based intervention to improve the levels of on-task behaviors of students diagnosed with ADHD.

The Effect of Yoga on Attention in Students Diagnosed with ADHD

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B.A., Villanova University, 2011

M.A., University of Connecticut, 2013

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APPROVAL PAGE

Doctor of Philosophy Dissertation

The Effect of Yoga on Attention in Students Diagnosed with ADHD

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## **Chapter I: Introduction**

Research has demonstrated that students who have difficulty maintaining focus and sustaining attention often struggle to perform adequately in school-based settings (Barbareis, Katusic, Colligan, Weaver, & Jacobsen, 2007; Peck, Kehle, Bray, & Theodore, 2005). Attention related difficulties significantly impact individuals who are diagnosed with Attention-Deficit/Hyperactivity Disorder (ADHD). ADHD is a disorder that is characterized by behaviors that involve “inattention and/or hyperactivity-impulsivity that interferes with functioning or development” (American Psychiatric Association (APA), 2013, p. 59). While some interventions exist that have been shown to help individuals who are diagnosed with ADHD to succeed in school settings (Abramowitz & O’Leary, 1991; DuPaul, Gormley, & Laracy, 2014; Fabiano et al., 2009), each has its own respective drawbacks. Based on the ever-present struggles that students with ADHD face in succeeding in schools, alternative school-based interventions such as yoga need to be conducted and researched in school-based settings in order to aid the symptoms of students who have been diagnosed with ADHD.

### **Characteristics of Students with ADHD**

According to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-V), in order to receive a diagnosis of ADHD, an individual must begin to present the symptoms in childhood before the age of 12. Approximately 5% of children and 2.5% of adults are currently diagnosed with ADHD, and these individuals have difficulties related to paying attention and staying on-task. They often struggle to listen attentively, focus when others speak to them, and may forget tasks and directions (APA, 2013).

Individuals diagnosed with ADHD may show difficulty controlling their responses, and may sometimes respond in a manner that appears as if they are acting before thinking about what they are doing. These individuals often exhibit increased levels of motor movement (i.e.,

fidgiting, tapping feet, continuously moving around) that can hinder their ability to complete assigned tasks (Barkley, 2006). A study conducted by Teicher, Ito, Glod, and Barber (1996), found that elementary and middle-school aged boys who had been diagnosed with ADHD who were not currently prescribed pharmaceutical medications demonstrated movement patterns in the head, elbow, and shoulder at rates that were much higher (i.e., two, three, and in some cases four times as high) than they were for control individuals who were not diagnosed with ADHD.

In school-based settings, students diagnosed with ADHD can present symptoms that resemble the individual lacking the motivation necessary to complete certain tasks. This presentation derives from the individual's difficulty paying attention and focusing. These difficulties can result in variability in schoolwork, where sometimes students will be able to complete work quickly, efficiently, and correctly, and other times they may struggle to complete their work and may turn in work that is incomplete, incorrect, or insufficient. While some variability is to be expected in children, the variability found in the work performance of individuals diagnosed with ADHD is often greater than what is to be normally expected (Barkley, 2006). The manifestation of these attention and hyperactivity related symptoms often leads to students struggling with detail in school, struggling to stay organized, and potentially struggling to follow teacher directions in school-based settings (APA, 2013).

### **Pharmaceutical Medications**

In order to combat the school-based difficulties faced by these individuals, students who are diagnosed with ADHD are often prescribed pharmaceutical medications, which aim to improve concentration and increase levels of attention (Abramowitz & O'Leary, 1991; Daughton & Kratochvil, 2009). The utilization of stimulant and, more recently, nonstimulant medications has been shown to be an effective way to increase the number of positive and on-task behaviors

exhibited by students who have been diagnosed with ADHD (Prasad et al., 2013); however, this does not always translate into academic success, as some research has demonstrated a nonsignificant effect of pharmaceutical medication on the achievement levels of students in reading and math (Barnard-Brak & Brak, 2011). These medications can also have negative side effects, including high blood pressure, difficulty sleeping (Graham et al., 2011), substantial changes in appetite, and stunted growth related to height and weight (Cortese et al., 2013). In addition, the usage of medications does not always completely alleviate the problems associated with ADHD, and individuals who begin medication regimens can develop a dependency on the medications in order to control symptoms; many students come to rely on medications to aid in improving their attention and focusing abilities (Harrison, Manocha, & Rubia, 2004).

Because of these drawbacks, it is important for pharmaceutical medications, when used with individuals diagnosed with ADHD, to be used in conjunction with other interventions. Harrison et al. (2004) claim that even clinicians “argue that an emphasis on medical therapy alone draws attention to the control of symptoms, rather than attending to the need for children to acquire important behavioural and social skills” (p. 481). It is evident that attempting to improve upon the focusing and attention related behaviors of a child diagnosed with ADHD may be better handled with a proactive and medication/intervention combined approach that is aimed at teaching new skills and modifying the individual’s behavior, rather than a singular reactive approach (Jensen & Kenny, 2004).

### **School-Based Interventions for ADHD Aimed at Improving School Behaviors**

A number of treatments have been designed to improve the behaviors of individuals who struggle with ADHD in school-based settings, particularly related to attention and focusing. Treatment options for ADHD that can be delivered in school settings are ideal because they

allow for the opportunity for multiple students to receive the intervention at a time, thus making them more cost-effective. Additionally, school-based interventions are beneficial because they target behaviors specific to school, such as maintaining focus during class lessons and sustaining attention during individual activities. These interventions include behavioral interventions (Abramowitz & O’Leary, 1991; DuPaul et al., 2014), home-school interventions (DuPaul et al., 2014; Villodas, McBurnett, Kaiser, Rooney, & Pfiffner, 2014), and self-regulatory interventions (Reid, Trout, & Schartz, 2005). Each of the aforementioned treatments can be implemented concurrently with pharmaceutical medications. They all have their own respective advantages and disadvantages, which will be subsequently discussed.

**Behavioral Interventions.** Research has demonstrated the effectiveness of behavioral interventions aimed at improving ADHD-related symptoms in various settings, including schools (Fabiano et al., 2009). These interventions have been shown to be an effective way to increase the number of positive behaviors and focusing abilities exhibited in a classroom setting for individuals who have been diagnosed with ADHD. Behavioral interventions attempt to diminish inappropriate behavior and increase instances of desired behavior using consistent reinforcement or punishment (Abramowitz & O’Leary, 1991; DuPaul et al., 2014). One type of behavioral intervention, contingency management, relies on providing a child with consequences (i.e., reinforcement, punishment) following a given action within an academic setting. Contingency management strategies that have shown positive effects on the focusing abilities of individuals diagnosed with ADHD include token economies, response-cost systems (DuPaul et al., 2014), and consistent verbal and nonverbal feedback from teachers and other school officials (Abramowitz & O’Leary, 1991). Token economies generally involve a student having to earn a reinforcing reward, while response-cost systems provide students with a set level of

reinforcement that is taken away when inappropriate behaviors are exhibited (DuPaul et al., 2014).

Reinforcement schedules can also be utilized to increase the number of instances of positive behaviors and decrease the number of instances of negative behaviors of students diagnosed with ADHD. Interventions of this type require providing students with reinforcement on a fixed or variable schedule. These schedules, however, require substantial amounts of time and resources to develop and implement, and require teachers or other school officials to continuously monitor the behaviors of a single student. Research has also demonstrated that negative behaviors often return and positive behaviors often decrease once reinforcement schedules are discontinued (Abramowitz & O’Leary, 1991).

Proactive components can be utilized in behavioral interventions, during which adults may, for instance, consistently prompt students of which behaviors are appropriate and inappropriate within the school setting (Antshel, 2015; DuPaul et al., 2014); however, many components of behavioral interventions often necessitate the use of consistent reinforcement or punishment given after an action occurs, and thus are reactive in nature. Additionally, teachers not only must be trained on how to appropriately deliver feedback or run a behavioral intervention, but also must spend significant amounts of time providing feedback to a single student (Abramowitz & O’Leary, 1991). Behavioral interventions require teachers to develop substantial amounts of skills in behavior management, which takes time and utilizes resources. Chronis, Jones, and Raggi (2006) note that “beneficial treatment effects rely on the consistent use of behavior modification techniques by teachers, who are sometimes resistant or unable to implement such programs as intended” (p. 489). Teacher failure to learn the appropriate techniques can result in a poor intervention that may not even improve behavior, or, in cases

where the intervention has improved behavior, may result in the behaviors of the student returning to baseline levels in the time following the completion of the intervention (Redfering & Bowman, 1981).

**Home-School Collaboration.** Chronis et al. (2006) state that when it comes to the problems associated with the symptoms of ADHD, “parents may develop maladaptive and counterproductive parenting strategies to deal with these problems that may serve to maintain or exacerbate existing behavioral difficulties” (p. 488). Because of this, a number of interventions currently exist regarding improving the behaviors of individuals diagnosed with ADHD through the education of parents and guardians about how best to work with their children after diagnosis (Antshel, 2015). This education can also be merged with in-school treatment efforts, resulting in joint home-school collaborative interventions aimed at improving the problem. Daily report cards are often used in these interventions so that teachers can communicate with parents daily regarding student behavior. Parents can then reinforce or punish the behavior of the student at home based on his or her behavior in school (DuPaul et al., 2014).

Home-school collaborative strategies have demonstrated some positive impacts on student behavior and attention, particularly with regard to student interaction with peers (Abramowitz & O’Leary, 1991). Some research has also shown that students who complete a home-school collaborative intervention can demonstrate decreased levels of ADHD symptoms postintervention when measured by parent scores on the Child Symptom Inventory (Villodas et al., 2014). The problem with home-school collaborative interventions is that they can require substantial teacher and parent training and substantial teacher time throughout the program (i.e., speaking with parents every day, consistently monitoring and keeping track of student behavior). Additionally, behavioral interventions of this type, which rely on at-home consequences, may

not necessarily carry over into school-based settings and improve the child's behavior in school (Abramowitz & O'Leary, 1991; Antshel, 2015).

**Self-Regulation.** Self-regulation interventions can be implemented in school-based settings with students who are diagnosed with ADHD. They involve teaching students how to recognize and be able to measure their own appropriate or inappropriate behaviors. In general, these interventions involve cueing a student at given points in time and asking him or her to determine whether a target behavior has occurred or is currently occurring (DuPaul et al., 2014). They can take on various forms that utilize differing levels of reinforcement. The first is self-monitoring, where students simply measure their own behaviors and track their progress without receiving any reinforcement. The second is self-monitoring plus reinforcement, which includes a reinforcing component that is provided to students if their behavior reaches a predetermined goal. The third, self-reinforcement, involves students measuring their own behaviors and then reinforcing themselves if they believe that they have reached a predetermined goal. The final, self-management, is the most resource intensive. It requires the same procedures as self-monitoring, but with an additional component of comparing the student's self-ratings to those of an additional observer. Students are then reinforced based on the accuracy of their own self-evaluations (Reid et al., 2005).

Research has demonstrated that self-regulation interventions can have a number of positive effects on students who are diagnosed with ADHD, including improving levels of attention (DuPaul et al., 2014; Reid et al., 2005). Yet, while self-regulatory strategies feature some important proactive components such as teaching students how to recognize when their behavior is appropriate or inappropriate, they do not provide students with the opportunity to practice the skills necessary to focus in classroom settings. Additionally, many self-regulation

strategies rely on reactive reinforcement that is provided after the student has completed a positive behavior.

### **The Need for a Proactive Intervention That Teaches Attention Skills**

While each of the abovementioned interventions has demonstrated success in improving the school-based behaviors of students who are diagnosed with ADHD, each has important drawbacks, particularly related to the time and resources necessary to implement the interventions. Largely, most of these interventions are reactive in nature and rely on the continuous rewarding or punishing of a child's behaviors in some way (Abramowitz & O'Leary, 1991; DuPaul et al., 2014). Even those that utilize proactive components do not provide students with opportunities to practice calming their bodies or focusing their attention. Because individuals who are diagnosed with ADHD often lack impulse control, struggle with self-regulation, and have difficulty paying attention and focusing, it is important that any intervention that they participate in focuses on teaching them the skills needed to address their deficiencies in these areas (Jensen & Kenny, 2004). Yoga is one such intervention that helps students practice focusing their attention and has demonstrated promising results, particularly when coupled with pharmaceutical medications (Harrison et al., 2004; Jensen & Kenny, 2004).

## **Chapter II: Review of the Literature**

Yoga interventions aim to help an individual to develop self-regulatory behaviors and monitoring techniques in which he or she can become more aware of his or her physical sensations and impulses. Yoga relies on the development of self-control, rather than on external stimuli for reinforcement or punishment, and the relaxation components of yoga interventions can help increase the focusing abilities and decrease the number of instances of impulsive behaviors of students with disabilities (Zipkin, 1985). This is extremely important when it comes to students who are diagnosed with ADHD because of their difficulties concentrating, their often seen hyperactivity, and their impulsivity (APA, 2013).

### **What is Yoga?**

Yoga is a holistic approach to health that engages both the body and the mind and teaches an individual an appropriate way to relax quickly and effectively, deal with and prepare for stressful situations, and improve levels of attention. It has been noted that yoga impacts the autonomic nervous system, thus improving the concentration and relaxation abilities of individuals. One part of the autonomic nervous system, the parasympathetic nervous system, is activated under conditions of relaxation, such as times of decreased heart rate and pacing of breath (Brown & Gerbarg, 2005). Yoga has been shown to result in activity in the parasympathetic nervous system (Harrison, Manocha, & Rubia, 2004). Peck et al. (2005) state, “the process of yoga deactivates the sympathetic division and stimulates the parasympathetic system resulting in a sense of calm, emotional balance, tranquility, and increased concentration” (p. 417). This stimulation of the parasympathetic system can result in improved abilities to concentrate, attend to relevant stimuli, and succeed in academic settings (Hagen & Nayar, 2014).

Yoga sessions can consist of many different forms and components. All programs, however, generally include the use of breathing techniques, relaxation techniques, meditation practices, flexible body poses, and physical activity (Noggle, Steiner, Minami, & Khalsa, 2012). One of the main goals of yoga is for individuals that complete it “to reach a state of mental equanimity, where responses to favorable or unfavorable external events are well under the individual’s control, and responses are moderate in intensity” (Kauts & Sharma, 2009, p. 40). It has been utilized as an inexpensive way to lower stress levels, generate both physical and mental relaxation, and improve overall health and well-being (Telles, Singh, Yadav, & Balkrishna, 2012), as well as to improve mood states and increase the self-regulation skills and focusing abilities of students (Hagen & Nayar, 2014). Moreover, physical activity, a main component of yoga, has been shown to improve levels of concentration and improve achievement levels in academic settings (Action for Healthy Kids, 2004).

While yoga is often conducted in studios or exercise classes, recent research has suggested that yoga can be effectively implemented in school-based settings (Noggle et al., 2012; Peck et al., 2005; Redfering & Bowman, 1981; Steiner, Sidhu, Pop, Frenette, & Perrin, 2013). Programs conducted in these settings are typically implemented either after-school (Jensen & Kenny, 2004; White, 2012) or during the school day (Peck et al., 2005), sometimes in place of a physical education class (Khalsa, Hickey-Schultz, Cohen, Steiner, & Cope, 2012). They can last anywhere from 10-minutes to 2-hours, but most are typically conducted in 30 to 40-minutes (Khalsa et al., 2012; Noggle et al., 2012). When implemented in schools, students are typically taught how to complete specific yoga poses, become self-aware of one’s feelings, meditate and visualize, and complete breathing techniques designed to bring on feelings of relaxation (Khalsa et al., 2012). In school-based settings yoga sessions can either be conducted

live using professional yoga instructors (Steiner et al., 2013) or with prerecorded videotapes that require individuals to follow along (Peck et al., 2005; Redfering & Bowman, 1981).

### **Yoga as an Intervention**

The research base behind utilizing yoga interventions for improving attention and concentration, particularly with individuals diagnosed with ADHD, has shown promising results. Studies, however, have varied greatly across a number of aspects, including setting, country of completion, dependent variable, and participants. Because this research base is relatively small, it is important to examine research studies that include yoga interventions aimed at improving the attention and concentration related abilities of individuals that demonstrate attention related difficulties without necessarily having received a diagnosis for ADHD, as well as research studies that were not necessarily conducted in school-based settings. This will allow for a more complete understanding of the existing outcomes and potential effects of yoga as an intervention aimed at improving attention for individuals who have been diagnosed with ADHD.

A number of studies have examined a yoga intervention aimed at improving the attention and concentration of individuals diagnosed with ADHD in non-school-based settings. One important study was conducted by Jensen and Kenny (2004), which explored the effects of a yoga intervention on students who were diagnosed with ADHD and stabilized on medication. The participants utilized in the study were Australian, and ranged in age from 8 years old to 13 years old. The intervention aimed to improve the participants' ADHD symptoms, including their difficulty focusing and their hyperactivity (Jensen & Kenny, 2004).

The program lasted for 20-weeks, and was implemented after school for 1-hour a week in a hospital setting. It incorporated breathing techniques, physical yoga poses, relaxation techniques, and attention techniques aimed at improving the concentration of the participants.

Parents of participants completed the Conners' Parent Rating Scales: Long (CPRS-R:L) during the pre-intervention phase of the study, as well as again post-intervention. Students who completed the yoga intervention demonstrated significant changes in many subscales of the CPRS between pre and post-intervention, including significant decreases in the ADHD Index, DSM-IV Hyperactive/Impulsive, and DSM-IV Total subscales. Improvements in scores on the Global Index Restless/Impulsive and ADHD Index subscales were also significantly greater than the changes on the same measures for the participants in a cooperative skill building control group were (Jensen & Kenny, 2004).

Another study conducted by Harrison et al. (2004) utilized Sahaja Yoga Meditation (SYM), which has been shown to result in decreased stress levels, improved levels of physical and mental relaxation, and improved levels of attention and concentration. The participants of the study were children between the ages of 4 and 12 who had been diagnosed with ADHD and their families. Most of the children that participated in the study (i.e., 31 out of 48 participants) were on medication that had been regulated by a pediatrician. The program occurred 2 times a week for 90-minutes for 6 weeks in a clinic. For the first three weeks of the program, parents and children attended different sessions, but for the last three weeks of the program one of the two weekly meetings involved both parents and children participating together. Parents were also given homework to complete with their children, in which it was requested by the researchers that families meditate together twice a day in the home setting (Harrison et al., 2004).

Parents completed the Conners Parent-Teacher Questionnaire (CPTQ) both pre and post-intervention, which was used in this study to measure ADHD symptoms. After the completion of the six-week program, parent scores were significantly lower on the CPTQ than they were pre-intervention. This result suggests that ADHD symptoms, such as inattention and hyperactivity,

were improved in children who completed the SYM intervention. Interestingly, a number of parents whose children were on medication at the beginning of the study (i.e., 55%) also noted that they were able to reduce the dosage of their children's medication by the end of the intervention. Parent perceptions taken from a separate survey also showed positive results post-intervention, as 92% of parents noted that SYM had a beneficial impact on their child (Harrison et al., 2004).

Haffner, Roos, Goldstein, Parzer, and Resch (2006) completed a study in Germany featuring nineteen coed second through fourth grade students who were diagnosed with ADHD. Eight of the participants were taking medication regularly for the disorder, and seven others were engaged in an additional type of therapy outside of the study, such as occupational therapy and behavioral therapy. The researchers stated that the treatments that these participants were receiving were delivered stably for the duration of the study. The study utilized a 2X2 crossover design to compare the effects of a yoga intervention and a typical exercise program on the ADHD related behaviors of the participants. The interventions were delivered in various outpatient settings, including a child and adolescent psychiatric hospital and the office of a child and adolescent psychiatrist.

The study lasted for 34 weeks, and for each week that the study elapsed parents of the participants completed a German ADHD rating scale (FBB-HKS) once per week to measure the ADHD related behaviors of the participants. The first six weeks of the study served as a baseline phase, during which time participants did not complete any intervention. Next, participants engaged in the intervention phase of the study. Half of the participants completed the yoga intervention for the first eight weeks of the intervention phase, took a six week break from intervention, and then engaged in the typical exercise program for the next eight weeks of the

intervention phase; the other half of the participants completed the interventions in the opposite order. Finally, six more weeks of data were collected on each of the participants, during which time they were not engaged in either of the interventions (Haffner et al., 2006).

Participants demonstrated significant differences in FBB-HKS scores after completing the yoga intervention when compared to the typical exercise program. This was shown across FBB-HKS scores related specifically to inattention, hyperactivity, and impulsivity, as well as to overall ADHD symptoms. This suggests that the yoga intervention was superior in improving behavior when compared to the typical exercise program. Additionally, by the end of the study FBB-HKS scores for the participants showed non-significant differences when compared to individuals who were not diagnosed with ADHD, suggesting that the intervention improved the ADHD related behaviors of the participants (Haffner et al., 2006).

Another study was conducted in Iran that examined the effects of a yoga intervention on the inattentive and hyperactive/impulsive behaviors of students with ADHD using the Child Symptoms Inventory (CSI-4). The CSI-4 can be used to screen for behavioral disorders such as ADHD. The participants of the study were 40 children between the ages of 9 and 12 that were all diagnosed with ADHD. Participants were randomly assigned to either an experimental or control group. Participants in the experimental group were provided with a yoga intervention twice weekly for 8-weeks, which lasted for 45-minutes. Participants in the control group received no intervention. Scores on the CSI-4, as completed by parents and teachers of the participants, were reduced significantly for participants that completed the intervention when compared to those of participants that were a part of the control group. This change was particularly notable when examining scores on subscales that measure inattentive and hyperactive/impulsivity symptoms of children. Students who completed the intervention demonstrated significant decreases in scores

on these subscales over and above the scores of their control group counterparts (Abadi, Madgaonkar, & Venkatesan, 2008).

In an inpatient psychiatric hospital setting, Hariprasad, Arasappa, Varambally, Srinath, and Gangadhar (2013) examined the effects of a yoga intervention for individuals suffering from severe ADHD. The participants of the study ranged in age from age 6 to age 13. A professional yoga instructor conducted yoga with the participants every day that they were enrolled in the inpatient hospital for at least one hour, and each of the participants underwent the intervention at least eight times. Individuals who completed the yoga intervention demonstrated statistically significant changes in their scores on the ADHD Rating Scale-IV (ADHD-RS) between admission into the hospital and post intervention. The result demonstrated that the yoga intervention was an effective way to improve the ADHD related behaviors of the participants.

Some research exists regarding yoga interventions aimed in improving attention for individuals who have been noted to have attention-related difficulties but who have not received a diagnosis of ADHD. Peck et al. (2005) conducted a study examining the impacts of a school-based yoga intervention on the on-task behaviors of students who were noted by classroom teachers to have difficulties related to attention in the classroom as defined by the exhibiting of off-task behaviors more than 20% of the time during class. Ten participants between the ages of six and ten who were enrolled in a school in the United States completed the intervention. The intervention was a structured videotape entitled “Yoga Fitness for Kids.” Students would view the half-hour videotape in the office of the school psychologist. The videotape featured an instructor who guided the children through breathing and relaxation techniques, as well as through physical movements. Students completed the intervention two times a week each week for three weeks in a group setting.

Participants were observed immediately following completion of the yoga intervention in their typical classroom environments for 10-minutes. The researchers used momentary time sampling to collect data on the on-task behaviors of the participants. Observers measured whether participants were on-task on 10-second intervals, and operationally defined on-task behavior as occurring anytime the eyes of a subject were focused on an appropriate stimuli (i.e., teacher directed lesson) or assigned work. Large effect sizes were seen between pre-intervention baseline measurements and post-intervention measurements for students that completed the intervention in each of the three grades, resulting in percentages of on-task behaviors that mirrored those of same aged peers after the intervention was completed. In addition, researchers noted that all of the students except for one rated the program highly, suggesting that the participants viewed the program favorably (Peck et al., 2005).

Steiner et al. (2013) examined the effects of a yoga intervention entitled Yoga Ed on students from an urban school setting. Four of the participants were diagnosed with ADHD, while the remaining thirty-seven participants had been diagnosed with various emotional and behavioral disorders. The students ranged in ages from age 8 to age 11, and the intervention lasted for over three months. Professional yoga instructors delivered the one-hour intervention to students in a group setting two times per week during the regular school day. Classroom teachers noted changes in attention that were significantly better after the students completed the intervention, suggesting that the intervention could be utilized to improve the concentration and focusing abilities of individuals who have difficulties with inattentiveness and hyperactivity.

Although few studies have specifically examined school-based yoga interventions and their effects on ADHD and its symptoms, those that have been completed demonstrate promising results. Redfering and Bowman (1981) utilized a yoga intervention on students who were

deemed to be hyperactive and behaviorally disturbed by school officials. The yoga intervention aimed to decrease the number of non-attending behaviors of students. It featured a pre-recorded tape that took students through a series of meditation and relaxation exercises, and lasted for a half-hour. The study, which was conducted in the United States, featured 18 students, 9 of which were randomly assigned to the treatment group and received the group intervention on 5 consecutive days, and 9 of which were randomly assigned to the control group and rested for the 30-minute period. Both groups were instructed to attend a specific room for their respective intervention session.

Observers, who were blind to which phase of the study participants were in or which group the participants were a part of, collected baseline and intervention data. They measured whether a student was exhibiting behaviors that were either attending or non-attending to a given task in a classroom setting across 30-minute observation periods. These observations occurred immediately following the intervention sessions. The participants in the intervention group demonstrated decreases in the mean total number of non-attending behaviors between baseline and post-intervention that were statistically significant. These differences were also seen when the difference in changes in the mean total number of non-attending behaviors between baseline and post-intervention scores for the intervention group were compared to the changes in the mean total number of non-attending behaviors between baseline and post-intervention for the control group. These results suggest that a school-based yoga intervention can be used to improve the attending behaviors of hyperactive individuals (Redfering & Bowman, 1981).

Mehta et al. (2011) conducted a combined yoga-play therapy intervention in a school-based setting. The participants of the study ranged in age from age 6 to age 11, and the program was implemented during the regular school day. Sessions lasted for one hour in a group setting.

About half of the hour was dedicated to the yoga and meditation portion of the intervention while the rest of the session was dedicated to behavioral play therapy. These sessions occurred two times a week for six weeks, and were run by volunteers from a local high school.

The researchers utilized the Vanderbilt questionnaires to assess the ADHD symptoms of the participants. Students demonstrated significant improvements in school performance scores from baseline to post intervention as measured by parent and teacher Vanderbilt questionnaires. Concurrently, almost 40% of students who participated in the intervention demonstrated improvements in parent and teacher ratings of their behaviors that were so significant that they could now be found within the normal range (Mehta et al., 2011). The results were still evident at a one-year follow-up as shown through scores on parent and teacher Vanderbilt questionnaires (Mehta et al., 2012). This is particularly important because of the feasibility and cost-effectiveness of the intervention. Not only was the intervention effective in improving the scores of students on Vanderbilt questionnaires, but it was also implemented by volunteers during the regular school day. This demonstrates that yoga interventions can be implemented in school settings in ways that are cost-effective and do not disrupt students' regular learning opportunities (Mehta et al., 2011).

### **Purpose of Study**

ADHD, which impacts approximately 5% of children, has substantial negative effects on individuals in schools, particularly with regard to attention and focusing (APA, 2013). A number of school-based interventions exist to address the attention and focusing abilities of individuals diagnosed with ADHD, such as behavioral interventions (Abramowitz & O'Leary, 1991; DuPaul et al., 2014), home-school collaborative interventions (Villodas et al., 2014), and self-regulatory interventions (Reid et al., 2005); however, all of the existing interventions feature drawbacks

such as expense, inefficient uses of time and resources, or negative side effects (Abramowitz & O’Leary, 1991). Additionally, many researchers argue that the best approach to improve the symptoms of ADHD in children is one that utilizes an intervention alongside a medication regimen. Yoga has been shown to be a viable alternative to the traditional treatment methods for ADHD, particularly with regard to improving the attention and concentration levels of students (Jensen & Kenny, 2004; Peck et al. 2005). This likely occurs because of yoga’s impact on and activation of the parasympathetic nervous system, which can result in improved abilities to concentrate, attend to relevant stimuli, and succeed in academic settings (Hagen & Nayar, 2014). The relaxation components of yoga interventions can help increase the focusing abilities and lower the amount of instances of impulsive behaviors of students with disabilities (Zipkin, 1985).

Yoga has been shown to increase attention levels in students, particularly those with ADHD, in many settings, including those that are school-based. The research that currently exists utilizes a number of different outcome variables, and has been conducted in widespread settings using participants with varying degrees of attention related difficulties (Mehta et al., 2011; Mehta et al., 2012; Redfering & Bowman, 1981). Currently, no research exists that examines the effects of a school-based yoga intervention on the on-task behaviors of elementary age students who are diagnosed with ADHD. The present study utilized the Yoga Fitness for Kids videotape as an intervention, and the researchers used direct observation methods to examine whether the intervention would effectively increase the percentage of intervals on-task for 7 to 9 year old students who are diagnosed with ADHD and are on a regular medication regimen for the disorder.

## **Chapter III: Methods**

### **Participants and Setting**

The participants of the study were between the ages of 7 and 9 years old, and were enrolled in elementary school in grades 2 or 3. Six students were screened to participate in the study; however, ultimately only four were selected to participate. The elementary school that the students were enrolled in was located in the northeastern part of the United States. All of the participants were taken from the same school, which eliminated the potential extraneous variable of school on the results of the study.

In order to be included in the study a participant had to have a current diagnosis of ADHD and had to currently be on a regular medication regimen for the disorder. The participant could not have repeated a grade at any point in his or her academic enrollment. Additionally, as part of the screening process for inclusion in the study, the behaviors of participants were observed across three 15-minute observation periods in their typical classroom environments. The percentage of intervals on-task for each participant was assessed. In order to be included in the study, participants had to demonstrate on-task behavior less than 80% of the time across the observation sessions. This criterion has been shown to signify problems related to attention in students (Rhode, Jenson, & Reavis, 2010), and was used to determine whether potential participants were demonstrating behaviors that were in need of an intervention.

### **Design**

Contact was made with a school that was interested in having students participate in the study, and written consent was attained at the district level. The school psychologist and classroom teachers from a consenting school contacted the parents/guardians of six potential participants that met the inclusion criteria for participation in the study, and requested permission

to share names and contact information with the researchers. Once parents/guardians agreed that they were interested in receiving more information about the study, a parent permission form was sent home to them that described relevant information about the study, such as its procedures, why their child was being invited to participate in the study, and the potential risks and benefits of the study. Because the participants were under the age of 18, parents/guardians of each participant had to sign the permission form before any study procedures could begin. Additionally, parents or guardians were required to inform the researchers if medications or dosages changed while the participant was enrolled in the study, as this information could explain changes in patterns in the data. The written parent permission form can be found in Appendix A. Once parental permission was attained, potential participants were read a script that described what would be expected of them if they were to participate in the experiment. Written assent was attained for each participant on the appropriate line on the parental consent form. The script that was read to participants can be found in Appendix B.

Once parental consent and student assent was attained, the screening process began and the six potential participants were observed across three 15-minute observation periods in their typical classroom environments. The percentage of intervals on-task was assessed for each participant. In order to be included in the study participants had to demonstrate on-task behavior less than 80% of the time across the observation sessions. This criterion has been used in previous research (Peck et al., 2005), and has been shown to signify problems related to attention in students (Rhode, Jenson, & Reavis, 2010). This screening provided researchers with potential participants who were demonstrating behavior in need of change, and thus justified their inclusion in the study.

The results of the screening procedures, including the average amount of time that each participant was on-task across the three screening observations, can be found in Table 1. Of the six participants who were screened, four boys in second grade who met the screening criterion were selected to participate in the study. Because all six of the participants met the screening criterion, two of the participants who were only diagnosed with ADHD and did not have a co-morbid diagnosis of any other mental disorder were selected to participate in the study first. Then, of the remaining four participants who met the screening criterion for participation in the study, Participant A3, who had a co-morbid diagnosis of Oppositional Defiant Disorder, and Participant E2, who had a co-morbid diagnosis of Mood Disorder – Not Otherwise Specified were randomly selected to participate in the study. Parents/guardians were notified if their child met the screening criterion and had been selected to participate in the study. Additionally, the parents/guardians of children who were not selected to participate in the study due to a higher number of students screening in than anticipated were also notified. The form that parents/guardians received informing them of this information can be found in Appendix C.

Table 1

*Screening Results for Study Participants*

Participant code	Average time on-task	Selected
A3	38.15%	Yes
B4	52.22%	Yes
C1	6.30%	No
D5	50.00%	Yes
E2	59.26%	Yes
F6	61.48%	No

This study featured a concurrent, multiple baseline design across four participants. Each participant served as his own control, which resulted in eight distinct phases – a baseline phase and an intervention phase for each participant. This equated to four potential instances in which

experimenters could observe an effect of the intervention on the percentage of on-task behaviors of participants.

The study began with the collection of baseline data for all four of the participants. In this phase, the students participated in a normal school day without any intervention. Direct observation data were collected for each participant during a full-class, small group, or individual activity in his typical classroom environment. The percentage of intervals that a student demonstrated on-task behavior during class was calculated. This occurred at least five times for each of the participants. Once five data points had been collected on each of the participants, the researchers randomly selected Participant B4 to begin the intervention phase of the experiment. This participant then completed the Yoga Fitness for Kids intervention an average of two times per week at a designated time, during the morning of the school day, for the duration of the experiment. Again, direct observation data were collected on this participant during class, and the percentage of intervals that the student was on-task was calculated. During this time, baseline data continued to be collected for the other three participants.

Once experimental control was demonstrated for Participant B4 in the intervention phase, Participant E2 was randomly chosen to begin the intervention phase of the experiment. This participant completed the Yoga Fitness for Kids videotape an average of two times per week for the duration of the experiment. Direct observation data were collected on the on-task behaviors of this participant during class. During this time, baseline data continued to be collected for the remaining two participants.

When experimental control was demonstrated in the intervention phase for Participant E2, Participant D5 was randomly chosen to begin the intervention phase of the experiment. This participant completed the Yoga Fitness for Kids videotape an average of two times per week for

the duration of the experiment. Direct observation data were collected on the on-task behaviors of this participant during class. During this time, baseline data continued to be collected for the remaining participant.

Finally, when experimental control was demonstrated in the intervention phase for Participant D5, Participant A3 began the intervention phase of the experiment. This participant completed the Yoga Fitness for Kids videotape an average of two times per week. Direct observation data were collected on the on-task behaviors of this participant during class. Once five data points had been collected in the intervention phase for Participant A3, the experiment concluded.

### **Dependent Variable**

Data were collected about the in-class behaviors of the participants using direct observation techniques. Direct observation is an observational technique in which data collectors observe the behaviors of students and make note of whether they are or are not engaging in a given behavior. The behavior that was examined in this study was on-task behavior. Shapiro (2011) developed a method for collecting direct observation data on student behaviors entitled the Behavioral Observation of Students in Schools (BOSS). The BOSS provides observers with an efficient way to measure, among other variables, the time students spend on-task; however, it requires observers to mark specifically whether a student was actively engaged or passively engaged. Because the researchers of this study were interested in total time on-task regardless of whether participants were actively or passively engaged, an operational definition of on-task behavior was developed for this study by combining Shapiro's definitions of active engaged time and passive engaged time. On-task behavior was operationally defined as any behavior in which a student is actively or passively participating in class. Examples include "writing; reading aloud;

raising a hand; talking to the teacher about the assigned material; talking to a peer about the assigned material...listening to a lecture; looking at an academic worksheet; reading assigned material silently; looking at the blackboard during teacher instruction; or listening to a peer respond to a question” (Shapiro, 2011, p. 42-43). Nonexamples include “talking about nonacademic material; calling out; aimlessly flipping the pages of a book...aimlessly looking around the classroom, silently reading unassigned material; and any other form of off-task behavior” (Shapiro, 2011, p. 42-43).

Data collectors were given a Direct Observation Data Collection Sheet (DODCS) and a recording of a “beep track.” A sample DODCS can be found in Appendix D. Data collectors were required to wear headphones during their observations, as the track beeped every 10-seconds. Each time the observer heard a beep he or she would mark whether the student was on-task at the precise moment that the beep occurred. The observer then made note of this in the appropriate location on the DODCS with a slash if the student was engaging in on-task behavior as defined by the operational definition. If the student was not engaging in on-task behavior, the appropriate space was left blank. For instance, if the observer heard the beep at the 20-second mark, he or she would immediately look to the participant and determine whether the behavior of the participant was on-task. If the behavior of the participant was on-task, a slash would be made in the box that corresponds to 20-seconds; if the behavior of the participant was not on-task, the corresponding box would be left blank. This procedure is known as momentary time sampling.

Each observation period lasted for 15-minutes, which resulted in 90 distinct points in time in which behavior was observed. This information was used to calculate the percentage of intervals on-task. The percentage of intervals on-task was computed at the conclusion of each observation by taking the total number of intervals in which on-task behavior was observed,

dividing it by the total number of intervals observed (90), and multiplying the result by 100. The result of this calculation was used as a data point that was later graphed.

The behaviors of the participants were examined in a typical classroom environment during which the participant was expected to be participating in a full-class lesson, working on an assignment in a small group setting, or working on an assignment individually. All of the data points for each of the participants were collected during the morning of the school day at a designated time. To ensure continuity across observation sessions, observation data were collected during the same subject for each of the participants. This occurred during both the baseline and intervention phases. During the intervention phase of the study, researchers collected data following the Yoga Fitness for Kids intervention during the same time frame and subject in which data were collected during the baseline phase. If the regular classroom teacher was absent, data were not collected on that day, as this would not have provided researchers with an accurate assessment of the participant in his typical classroom environment. Additionally, data were not collected during specials or assemblies.

Data were collected for each participant approximately every other day during the baseline phase and an average of twice per week during the intervention phase, unless scheduling issues or absences prevented this from occurring. The study is of concurrent multiple baseline design, which means that individual participants have slightly different numbers of data points in both the baseline and intervention phases. Depending on when a given participant began the intervention phase, he may have been observed 5 to 11 times in the baseline phase and 5 to 7 times in the intervention phase. This resulted in a minimum of 12 and a maximum of 16 total times that a given participant was observed.

If a participant was absent from school, data were not collected on the day on which he was absent, and instead was collected again on the next day in which the participant was present in school. If a participant left the room during an observation period (i.e., to use the restroom) the observer would make note of this absence and would skip each interval on the data sheet that the participant missed. When the participant returned to the classroom the observer would continue the observation at the appropriate interval on the DODCS, and would collect data until behavior was observed for 15-minutes worth of time in which the participant was present in the classroom. In cases in which a participant was a part of the intervention phase of the study and did not complete the intervention for a given day, data were not collected for that participant on that day. Data were collected again beginning on the next day on which the participant completed the intervention.

### **Interobserver Agreement**

The researcher, as well as another qualified individual, served as data collectors in this study. In order to be deemed qualified to be a data collector, an individual had to have completed coursework in behavioral assessment or pupil behavior. The data collectors also had significant experience collecting direct observation data on students at the elementary level.

Data collectors were trained appropriately using sample clips. There were 12 sample clips, which ranged from 10-minutes to 12-minutes in length. The sample clips depicted elementary aged students engaging in typical classroom experiences that include full-class, small group, and individual activities. They were meant to simulate an actual direct observation experience, and included a beep track in the background that beeped every 10-seconds. The clips were coded for on-task behaviors and an answer key was generated for each individual clip. At each beep, observers marked whether a student was engaging in on-task behavior on a DODCS; this

occurred for the duration of the sample clip. When the clip concluded, observers calculated their interobserver agreement (IOA) by comparing their observations to an answer key. Observers then divided their number of agreements with the answer key by the total number of intervals, and multiplied the answer by 100. This resulted in a percentage of agreement with the answer key.

Observers had to demonstrate adequate levels of agreement with the answer key in order to be able to participate as a data collector in this study. An adequate level of agreement was defined as at least 90% agreement with the answer key for 3 consecutive sample clips. If an observer demonstrated lower than 90% agreement at any point, even if they had reached 90% agreement on any previous sample clips, the observer still had to maintain 90% agreement for the next 3 consecutive sample clips. Once the observers met this criterion, they were cleared to participate in the observation process.

IOA was collected during at least 20% of data points in each phase for each of the four participants, as well as during one of the observations during the screening portion of the study. During IOA trials, two observers were present to observe the on-task behaviors of a participant. Each time that both observers marked that a student was on-task or not on-task counted as an agreement, and each time that the observers did not agree on whether the student was on-task counted as a disagreement. The number of agreements found between the two observers was divided by the total number of intervals in the session, which was then multiplied by 100. If IOA was not greater than or equal to 80% the data collectors would have had to go through training again and demonstrate their ability to correctly collect direct observation data before continuing with the data collection process; however, this did not occur during the study, as all IOA remained above 80% agreement.

On all occasions in which IOA occurred during the study, the observers agreed on at least 80% of intervals, but less than 100% of intervals. In these cases, the total percentage of intervals on-task for the given data point was generated by finding the average of the number of on-task intervals found by the two observers. For example, if Observer A collected data that showed that Participant B4 was on-task for 53 out of the 90 intervals, and Observer B collected data that showed that the participant was on-task for 51 out of the 90 intervals, the number of on-task intervals for the data point was calculated by adding the number of intervals on-task found by each observer and dividing the result by 2 (i.e.,  $(53+51)/2 = 52$ ).

### **Independent Variable**

The Yoga Fitness for Kids videotape served as the independent variable in this study. There are two existing versions of the videotape, though only the version designed for participants who are ages 7 to 12 was relevant for this study. The videotape lasts for approximately 30-minutes, and requires participants to follow along with a female yoga instructor as she leads the children through breathing and relaxation techniques, as well as through physical movements. Approximately 86% of the videotape requires participants to engage in physical yoga poses that involve stretching their arms, legs, shoulders, and back muscles; however, students are regularly encouraged to focus on their breathing during these exercises. The other 14% of the videotape encourages participants to engage in meditation. The videotape was played on a Smart Board in a room that was devoid of distractions and interruptions and had substantial space to complete yoga-based exercises. The researchers delivered the intervention individually during a designated time that was pre-established with teachers. The intervention was delivered during non-academic time so that participants would not miss any schoolwork. The researchers supervised the intervention to ensure that the

participants completed the intervention and that no audio or video malfunctions occurred. The participants viewed the videotape an average of two times per week that they were in the intervention phase of the experiment.

### **Treatment Integrity**

In order to confirm that the intervention was delivered correctly and regularly for each of the participants during the intervention phases of the experiment, a treatment integrity questionnaire was created. Each time the intervention was delivered the questionnaire had to be completed by whoever delivered the intervention (i.e., the researcher or the data collector). The questionnaire asks whether: (1) all of the necessary participants were present for the intervention; (2) the participants that were present for the intervention wore the appropriate clothing to participate in the intervention (i.e., clothes that allowed them to move around comfortably); (3) the complete Yoga Fitness for Kids videotape was run by the researcher or data collector without video or audio malfunctions; and (4) the participants participated in the intervention by following along with the instructor in the videotape. See Appendix E for the treatment integrity questionnaire.

## Chapter IV: Results

In order to best assess the results of the study, the researchers first utilized visual analysis of a graph of each participant's data points. The overarching goal of visual analysis of the data for each participant was to examine baseline data points in comparison to intervention data points to determine the effectiveness of the Yoga Fitness for Kids intervention on the levels of on-task behavior of the participants. Visual analysis was conducted in accordance with the visual analysis protocol and evidence standards set forth by What Works Clearinghouse (WWC; Kratochwill, et al., 2010). The researchers took into account a number of factors at the baseline, within, and between phase levels for each participant. Individual results were examined together to determine whether the overall results of the study provided evidence in support of the intervention.

At the baseline phase level, the researchers examined the variability and predictability of the baseline behaviors, as well as the behavioral trends for all of the participants. At the within phase level, the variability, predictability, and trend directions of the behaviors of the participants during the intervention phase were inspected. Finally, at the between phase level, the baseline and intervention phases were compared. Most importantly, at the between phase level the researchers determined whether a significant improvement in on-task behavior was demonstrated by each participant in the intervention phase when compared to the baseline phase. This involved careful examination of overlapping data points and changes in level, trend, and variability between the phases for each of the participants.

Additionally, the researchers calculated an effect size for each participant through examination of nonoverlapping data points between phases using the Tau-U statistic. This statistic is generated by comparing all of a participant's data points with one another while also

controlling for positive trends in the baseline phase (Parker, Vannest, & Davis, 2011). The results of these calculations provided the researchers with a more concrete understanding of the degree to which the intervention impacted participant behavior. This section will conclude with information about IOA across participants and the results of the treatment integrity questionnaires.

### **Graphical Representation and Visual Analysis**

A graphical representation of the data can be seen in Figure 1. Participant B4 demonstrated a predictable negative trend with low levels of variability in behavior during the baseline phase that suggested the need for an intervention. All baseline data points fell well within the study's established criteria needed to demonstrate a behavior in need of change (i.e., on-task less than 80% of intervals), and ranged in value from 27.78% to 57.78% of intervals on-task. When the intervention was implemented, Participant B4's behavior improved gradually and showed an overall positive trend; however, significant variability existed during the intervention phase, as the participant's behaviors ranged from 38.89% to 84.44% of intervals on-task. This participant demonstrated three data points in the intervention phase that overlapped with data points from the baseline phase, resulting in 43% overlap (i.e., 3 out of 7 data points).

When comparing the last three data points from the baseline phase with the first three data points from the intervention phase, two of Participant B4's intervention phase data points showed overlap. Variability increased in the intervention phase when compared to the baseline phase, and the overlaps in the data suggest that the intervention did not immediately improve behavior; however, behavior from the baseline phase was trending negatively, while behavior from the intervention phase immediately trended in the positive direction. Based on Participant B4's intervention data points, the researchers expect that if data were to continue to be collected

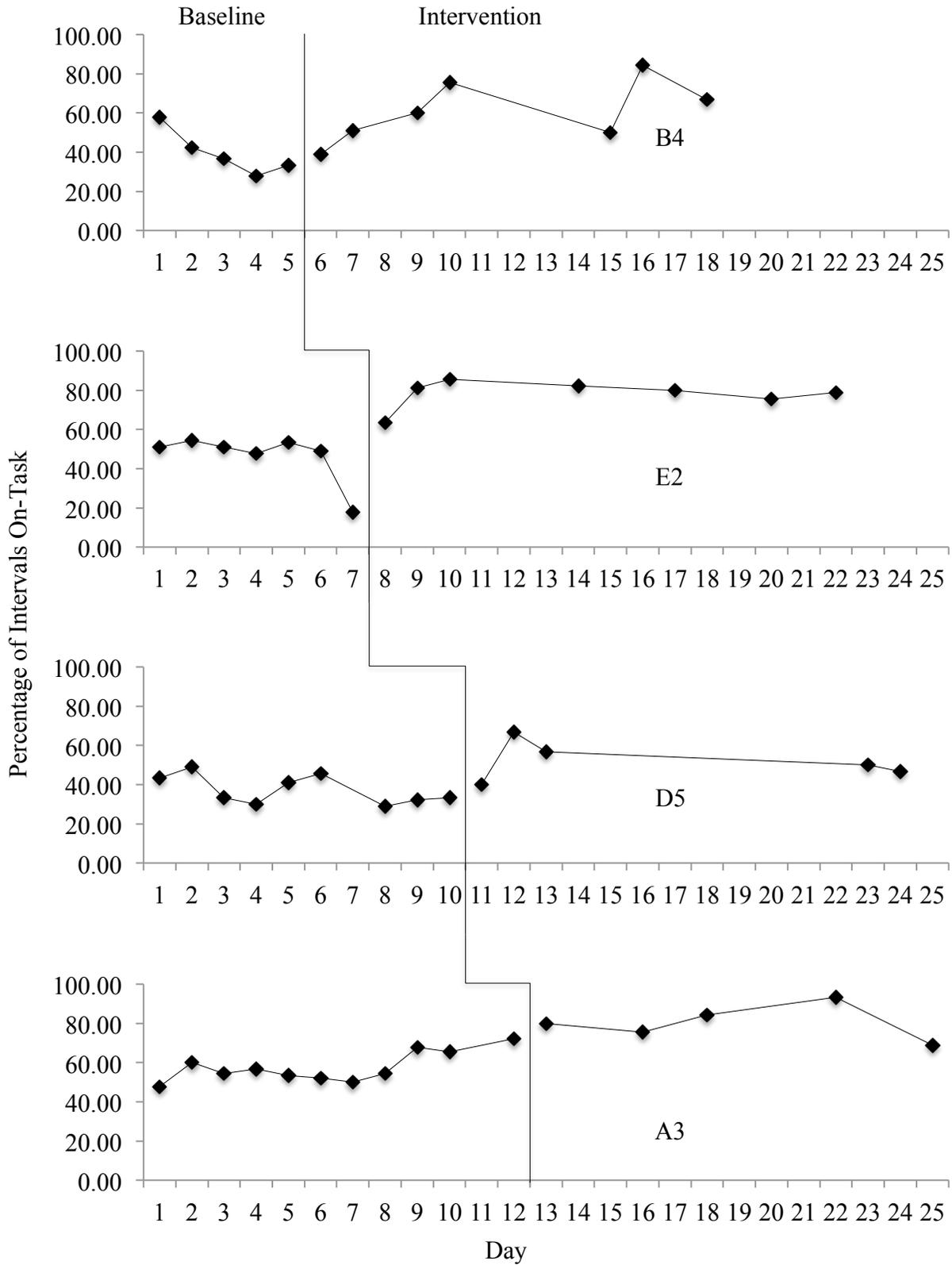


Figure 1. Percentage of intervals on-task during observation periods across participants.

the participant's behavior would improve gradually over time. The researchers determined that this participant demonstrated an overall improvement in behavior that supported the effectiveness of the yoga intervention, but these results should be interpreted cautiously as the participant demonstrated variability within the intervention phase.

Participant E2 demonstrated baseline behaviors that were predictable, showed little signs of variability, and featured a consistent and slightly negative trend. Baseline data points ranged between 17.78% and 54.44% of intervals on-task; however, 6 of the 7 baseline data points ranged between 47.78% and 54.44% of intervals on-task. The participant's behavior during the baseline phase of the study demonstrated behavior that was in need of change. Intervention data points demonstrated little variability and ranged between 63.33% and 85.56% of intervals on-task. Behavior remained relatively stable in the intervention phase, as 6 of the 7 intervention data points ranged between 75.56% and 85.56% of intervals on-task.

No overlapping data points existed between the baseline and intervention phases for Participant E2. The first three data points of the intervention phase demonstrated a marked change in behavior when compared to the last three data points of the baseline phase. This suggests that the implementation of the intervention had an immediate effect on the participant's behavior. Little variability existed within either phase, but the level of behavior was clearly improved from the baseline to the intervention phase. Based on these results, the researchers determined that the intervention was effective in improving the on-task behavior of Participant E2.

Participant D5 demonstrated levels of baseline behavior that were in need of change, as baseline data points ranged between 28.89% and 48.89% of intervals on-task. Behavioral trend was negative, although baseline behavior was somewhat variable and was slightly less

predictable for Participant D5 than it was for other participants. Within the intervention phase, this participant demonstrated some initial variability, as intervention data points ranged from 40.00% to 66.67% of intervals on-task. Two of the five intervention data points overlapped with data points from the baseline phase, resulting in 40% overlap. Behavior demonstrated a slight downward trend by the end of the intervention phase; however, despite this trend, the level of behavior in the intervention phase was improved when compared to the level of behavior in the baseline phase.

When comparing the first three data points of the intervention phase to the last three data points of the baseline phase, only the first point in the intervention phase overlapped with the baseline phase. The next two data points were improved over and above the data points found within the baseline phase, suggesting that it took the participant one session of yoga before his behavior was improved within the classroom. A possible explanation for this result can be found in the discussion section below. Additionally, a significant gap exists between data points 3 and 4 in the intervention phase for Participant D5, which will also be addressed in the discussion section below. Overall, based on the increase in the level of intervals of on-task behavior between the baseline and intervention phases, the researchers determined that the intervention moderately improved on-task behavior for Participant D5.

Baseline behaviors for Participant A3 ranged from 47.78% to 72.22% of intervals on-task. He demonstrated behavior that was on-task on less than 80% of intervals for all of his baseline data points; however, the data showed a positive trend and little variability as the baseline phase progressed, which suggests that behavior was improving prior to implementation of the intervention. Within the intervention phase, Participant A3 demonstrated some variability, as data points ranged from 68.89% to 93.33% of intervals on-task. Behavior showed positive trends

in the intervention phase and only one of the five intervention data points overlapped with the data points from the baseline phase, resulting in 20% overlap. None of the last three data points from baseline phase overlapped with the first three data points from the intervention phase. Participant A3's behavior showed some immediate change between phases, and the level of the data in the intervention phase was improved when compared to the level of the data in the baseline phase.

Because of the positive trend in the baseline data points, it is difficult to discern how much the intervention improved Participant A3's behavior using only visual analysis techniques. The researchers could not clearly determine whether the intervention was the reason for the improvement seen in the participant's behavior; therefore, it was determined that the intervention did not demonstrate evidence of improving behavior for Participant A3. Overall, Participant B4, Participant E2, and Participant D5 showed improvements in behavior. Because three of the four participants demonstrated improvements in behavior, and one participant demonstrated no improvement in behavior, the researchers determined that the yoga intervention implemented in this study demonstrates moderate evidence in its ability to improve the on-task behavior of students diagnosed with ADHD.

### **Statistical Analysis**

In order to gain a more complete understanding of the effectiveness of the intervention, the researchers conducted statistical analysis by calculating the Tau-U statistic for each of the participants. The Tau-U statistic is an effect size measurement that can help researchers determine the extent to which a participant demonstrated improvement in behavior from the baseline to intervention phase. This statistic was deemed appropriate for analyzing the results of this study because the Tau-U statistic allows researchers to control for positive trends in baseline

behavior (Parker et al., 2011). This calculation was particularly important for Participant A3's results, as he was the only one of the four participants who showed a positive trend in behavior during the baseline phase.

Any Tau-U score .65 and below is interpreted to mean that the intervention had a weak effect on behavior. Tau-U scores between .66 and .92 are interpreted to mean that the intervention had a medium effect on behavior. Tau-U scores .93 and above are interpreted to mean that the intervention had a strong effect on behavior (Parker & Vannest, 2009; Rakap, 2015). Tau-U scores were calculated using the Tau-U calculator found at <http://www.singlecaseresearch.org/calculators/tau-u>. The results of the Tau-U calculations for each participant, as well as the weighted average Tau-U score of all of the participants can be seen in Table 2.

Table 2

*Tau-U Scores for Study Participants*

Participant code	Tau-U score	<i>p</i> -value
B4	0.77	0.028
E2	1.00	0.002
D5	0.78	0.020
A3	0.60	0.062
Weighted Average of B4, E2, D5, A3	0.79	N/A

Participant B4 (Tau-U = 0.77;  $p = 0.028$ ) and Participant D5 (Tau-U = 0.78;  $p = 0.020$ ) both received Tau-U scores that suggested that the yoga intervention had a moderate effect on improving their on-task behaviors. Because Participant E2 demonstrated no overlap between his baseline and intervention data points he received a Tau-U score that suggested that the intervention had a strong, positive effect on his behavior (Tau-U = 1.00;  $p = 0.002$ ). Participant A3 (Tau-U = 0.60;  $p = 0.062$ ) received a Tau-U score that suggested that even when controlling for positive baseline trend the yoga intervention had a weak effect on behavior. Overall, the

weighted average Tau-U score across participants (Tau-U = 0.79) suggested that the intervention had a moderate effect on the behavior of the participants. The results of the Tau-U calculation support the researchers' interpretation that overall, the yoga intervention improved the on-task behavior of students diagnosed with ADHD.

### **Interobserver Agreement and Treatment Integrity**

IOA was conducted for at least 20% of data points for each participant in both the baseline and the intervention phase. All IOA remained above 80% agreement for the duration of the study, and thus no data collectors needed to be retrained at any point. Percentages of agreement ranged from 90.00% to 96.67% during the baseline phase and 91.11% to 97.78% during the intervention phase across participants.

No parents/guardians contacted the researchers regarding changes in medication; therefore, it is assumed that all participants remained on their typical medication regimen for the duration of the study. In addition, no teachers implemented any new behavior plans at the individual or classroom level during the experimental period that could account for the behavioral changes seen in participants. The results of the treatment integrity questionnaires showed that Component 1, Component 2, and Component 3 of the intervention (i.e., all of the necessary participants were present for the intervention; the participants that were present for the intervention wore the appropriate clothing to participate in the intervention; and the complete Yoga Fitness for Kids videotape was run by the researcher or data collector without video or audio malfunctions) were implemented 100% of the time. Component 4 (i.e., the participants participated in the intervention by following along with the instructor in the videotape) was implemented 79% of the time. Participants A3 and E2 followed along with the instructor and completed the intervention 100% of the time. Participant D5 did not follow along with the

instructor and complete the intervention during the first intervention session. Despite the researcher repeatedly encouraging him to try, he stated that he just wanted to watch the video during the initial session, and did so quietly. This participant completed the intervention the next four times, which meant that Component 4 of the intervention was implemented 80% of the time for this participant.

Participant B4 showed initial defiance toward completing the intervention, as he also stated that he only wanted to watch the videotape and not complete the poses. He explained that he would rather do the poses at home and wanted to take notes on what he was watching. His teacher reported that he was drawing diagrams of the poses in class and creating a book that he could look at while he completed yoga at home. Multiple conversations were had, both before and after intervention sessions with the student and the student's teacher, during which he agreed to complete the poses; however, despite these conversations, Participant B4 continued to refuse to complete the poses for the first four intervention sessions. During this time the student sat quietly, remained attentive to the video, asked questions about what was going on, and completed the visualization portion of the intervention; however, he did not follow along with the instructor and engage in any of the poses until the final three sessions, meaning that Component 4 of the intervention was implemented 43% of the time for this participant. Overall, components of the intervention were implemented 95% of the time.

## Chapter V: Discussion

The results of the study demonstrate that a school-based yoga intervention can effectively increase the percentage of intervals on-task for elementary students who are diagnosed with ADHD and are on a regular medication regimen for the disorder. The researchers' visual analysis interpretations aligned with the Tau-U effect size calculations for each participant. More specifically, both the researchers' analysis of each participant's graph and the results of statistical analysis procedures determined that the intervention demonstrated beneficial impacts on behavior for Participant B4, Participant E2, and Participant D5, and an inconclusive effect on behavior for Participant A3. Both measures were also in agreement that the intervention demonstrated an overall moderate, positive effect on behavior across participants. Overall, the results of this study support the results of other studies that have examined school-based yoga interventions on children, which have increased levels of on-task behavior (Peck et al., 2005), improved levels of attention (Steiner et al., 2013), decreased instances of non-attending behaviors (Redfering & Bowman, 1981), and improved scores related to ADHD symptoms on the Vanderbilt questionnaire (Mehta et al., 2011; Mehta et al., 2012). Additionally, the results found here align with the positive results found in studies that have examined yoga interventions delivered outside of school settings that aimed to improve ADHD related variables. These studies have demonstrated improvement in ADHD symptoms such as inattentiveness and hyperactivity as shown through parent reports on rating scales such as the ADHD-RS (Hariprasad et al., 2013), the Conners (Harrison et al., 2004; Jensen & Kenny, 2004), the CSI-4 (Abadi et al., 2008), and the FBB-HKS (Haffner et al., 2006).

The results found here can be best understood when examined in accordance with prior works of research that have attempted to explain why yoga can be beneficial in improving

attention related outcomes. As mentioned in Hagen and Nayar's article (2014), yoga impacts and activates the parasympathetic nervous system, which can result in improved abilities to concentrate, attend to relevant stimuli, and succeed in academic settings. Additionally, the relaxation components of yoga interventions can help increase the focusing abilities and lower the amount of instances of impulsive behaviors of students with disabilities (Zipkin, 1985). The yoga intervention utilized in this study improved levels of on-task behaviors in participants, suggesting increased concentration and levels of attention. A likely explanation for the results found here is that the yoga intervention directly improved participant behavior by allowing students the opportunity to practice calming their bodies and focusing their attention. The participants were then able to utilize the skills that they had practiced during intervention sessions in the classroom and remain on-task more often and for longer periods of time.

The Yoga Fitness for Kids intervention that was implemented in this study was done so easily, as it only required a video player and enough space for a single participant to complete yoga poses. Participants did not need to have any prior experiences with yoga, and could simply learn along the way. The intervention did not require participants to miss any schoolwork, as it was implemented during non-academic time, and was proactive, in that it taught the participants the skills necessary to maintain their attention in the classroom and provided them with opportunities to practice focusing. Because it was delivered via videotape, no researchers were required to attain the necessary qualifications needed to teach yoga, and the researchers were able to ensure that each participant was receiving the same exact intervention during each intervention session. These aspects of the Yoga Fitness for Kids intervention are important, as other yoga interventions that have been implemented have necessitated the usage of professional yoga instructors (Hariprasad et al., 2013; Steiner et al., 2013). Additionally, this particular yoga

intervention required only 30-minutes to complete. Many yoga interventions that have aimed to improve attention related behaviors in children have required longer time frames to complete, including 45-minutes (Abadi et al., 2008), 1-hour (Haffner et al., 2006; Hariprasad et al.; Jensen & Kenny, 2004; Mehta et al., 2011; Mehta et al., 2012; Steiner et al., 2013), and 90-minutes (Harrison et al., 2004).

### **Are the Results an Underestimation?**

The results of this study may provide an underestimation of the effects that yoga can have on the levels of on-task behaviors of students diagnosed with ADHD for a number of reasons. For one, treatment integrity was in issue for Participant B4 and Participant D5, as both participants did not complete the physical yoga poses associated with the intervention during 100% of their intervention sessions. As mentioned in the Results section above, Participant B4 did not complete the physical component of the intervention in his first four intervention sessions, and Participant D5 did not complete the physical component of the intervention in his first intervention session. During these sessions, both participants were passively engaged and watched the video quietly while focusing on the screen and completing the visualization portion of the videotape. Nonetheless, Participant B4 still demonstrated an immediate positive trend in on-task behaviors during the first four data points of his intervention phase. Participant D5's initial intervention phase data point was largely in-line with his baseline data points; however, when Participant D5 began completing the physical aspects of the intervention during his second intervention session, he showed an immediate increase in the number of intervals that he was on-task. Based on these results, it is likely that Participant B4 and Participant D5 would have demonstrated more significant improvements in behavior had either of them completed all components of the intervention for all of their intervention sessions.

Another reason why the results of this study may underestimate the effectiveness of the intervention is because of the significant amount of time that elapsed between Participant B4's fourth and fifth data points and Participant D5's second and third data points (i.e., five days for participant B4 and eight days for Participant D5, respectively). While the researchers were able to implement the intervention an average of two times per week overall, it was the researchers' intention to implement the intervention on a more regular schedule; however, participant absences, teacher absences, and unexpected schedule changes in the school day made this an impossibility. The intervention was implemented as regularly as possible given a multitude of factors outside of the researchers' control. It is likely that the gap between data points for these participants impacted the effectiveness of the intervention, and may have limited the level to which Participant B4 and Participant D5 demonstrated behavioral improvement.

The positive trend in baseline behavior demonstrated by Participant A3 also limited the results found here and may underestimate how effective yoga interventions can be at improving levels of on-task behavior in students. Even though the researchers utilized the Tau-U statistic to control for positive trends in baseline behavior, the participant's baseline data points were rapidly approaching levels that suggested that he did not need any intervention for on-task behavior (i.e., his data points were approaching 80% of intervals on-task). From a visual analysis standpoint, this made it nearly impossible for the researchers to find a positive effect of the intervention on his behavior. A participant who is already demonstrating levels of on-task behavior at that level has little room to improve, and thus, Participant A3 had less opportunity to demonstrate improvements in his behavior when compared to the other three participants. It would be difficult to determine whether Participant A3's behavior improved because of the implementation of the intervention, or whether it would have continued to improve regardless of

whether an intervention was implemented. While the increases in baseline behavior were excellent for the student and showed that his behavior was improving in the classroom, they limited the ability of the researchers to find an effect on behavior due to the intervention.

Interestingly, both Participant B4 and Participant D5 mentioned on multiple occasions that they would prefer to complete the intervention with a friend. While it was not possible to alter the delivery of the intervention during the study, this has important implications for yoga interventions implemented in non-research settings. The results found here suggest that individually based yoga interventions can benefit students; however, research has also demonstrated that school-based yoga interventions delivered in group settings can improve attending behaviors in students (Peck et al., 2005; Redfering & Bowman, 1981). It is likely that some participants may benefit more from or prefer to complete a yoga intervention individually (i.e., Participant E2 in this study), while others may demonstrate more positive outcomes if the intervention is completed in a group setting. It is possible that Participant B4 and Participant D5 may have shown more significant improvements in levels of on-task behavior had they been able to complete this intervention in a group setting. Due to its ease of implementation, The Yoga Fitness for Kids videotape examined here is one such yoga intervention that could be delivered easily and efficiently in individual or group settings.

### **Limitations**

Admittedly, the study as designed features a few limitations. While the researchers were able to mitigate the potential confounds of grade and school on the results of the study, they were not able to mitigate the potential confound of class. Participants A3 and E2 came from one second grade classroom, while participants B4 and D5 came from another second grade classroom. Ideally, all students would have come from the same classroom, but due to the

specificity of the population that met the inclusion criteria for participation in this study, there simply was not a single classroom available to the researchers that featured four eligible participants.

Scheduling was also a limitation present in the study. Due to student and teacher absences, scheduled school days off, in-school assemblies, weekends, and the ever-present scheduling changes found in elementary school classrooms, observation and intervention periods could not be scheduled as regularly as the researchers would have preferred. While observations were conducted at the same time of day and in the same subject for each participant for the duration of the study, they could not be scheduled every day. The researchers were able to collect baseline data points approximately every other day, and intervention data points an average of two times per week. Ideally, an observation would be conducted every day, and the students who were in the intervention phase of the study would complete the intervention daily; however, such data collection procedures were not possible in this study.

Furthermore, while the researchers observed participants during the same time of day and during the same subject for all observation periods, the activity that a participant completed during the observation varied throughout the study. Observations included times when the individual was required to complete an activity on his or her own, in a group setting, or in a full-class setting. Overall, the observation periods captured the student interacting in a classroom setting during a typical academic classroom activity; however, the specific activity that the student was completing could have impacted his behavior during the observation. Additionally, due to the school year ending shortly after the final intervention data point was collected, it was not possible for the researchers to collect follow-up data. Because of this, it is unclear whether the results of the study had lasting effects.

In terms of the presence of researchers in the classroom impacting participant behavior, the participants were unaware that they were being observed during the baseline phase because they did not have contact with the researcher; however, the same researcher implemented the intervention and conducted the observations immediately after implementation. It is possible that participants were aware of the researcher's presence in the classroom during the intervention phase, which may have impacted their behavior during these observation periods. Additionally, while data collectors utilized the strict operational definition of on-task behavior when conducting observations, they were not blind to which phase of the study each participant was currently completing.

While the results of the study demonstrate that yoga as an intervention can help students with ADHD to improve the percentage of time that they are on-task in classroom settings, the magnitude of the results are open to interpretation. In order to attain a more concrete understanding of how successful the intervention was at improving student behavior over and above that of visual analysis, the researchers chose to utilize the Tau-U statistic. The researchers felt that this procedure of statistical data analysis was most appropriate because it controls for trends in the data that occur during the baseline phase; however, a number of other statistics could have been selected to analyze the data that may have generated slightly different results.

Finally, because the researchers utilized a single subject design, the results of the study lack generalizability to the population at large. The results are only applicable to a specific population – mainly, male elementary school students diagnosed with ADHD in northeastern elementary schools. Generalizability is further limited because two of the students also had co-morbid diagnosis of another mental disorder.

## **Areas of Future Research**

Future research studies should aim to replicate the results found here, which will improve the research base behind school-based yoga interventions for students who are diagnosed with ADHD. Yoga interventions for students who are diagnosed only with ADHD and who do not have any co-morbid diagnoses of any other mental disorders should be examined. Studies should examine the effects of yoga interventions on students who are on medication and who are not on medication, of differing ages and genders in different areas of the world. Larger scale, randomized controlled trials featuring more participants would allow for more accurate statistical analysis procedures, and would provide researchers with results that are more generalizable than those deduced from single subject study designs. Additionally, while all yoga interventions are comprised of similar components, they often place different levels of emphasis on breathing techniques, relaxation techniques, meditation practices, flexible body poses, and physical activity. Yoga interventions of differing lengths that emphasize various components of yoga should be utilized with students who struggle with focusing and attention in school. Interventions should also be conducted in individual and group settings, as this difference may impact the effectiveness of the intervention on student behavior. Studies should examine lengthier yoga interventions (i.e., those conducted for months at a time) and feature follow-ups that extend months or years into the future to determine whether yoga interventions have lasting effects on levels of attention in school.

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## Appendix A

# Parental Permission Form for Participation in a Research Study



**Principal Investigator:** Dr. Thomas Kehle

**Student Researcher:** Andrew Petsche

**Study Title:** The Effect of Yoga on Attention in Students Diagnosed with Attention Deficit Hyperactivity Disorder

### Introduction

Your child is invited to participate in a research study that is examining how the viewing of a yoga videotape impacts the focus and attention of students who have been diagnosed with Attention Deficit Hyperactivity Disorder (ADHD). Your child is being asked to participate because he/she currently meets the inclusion criteria for participation in this study. The yoga videotape aims to improve your child's ability to pay attention during class. This permission form will give you the information you will need to understand why this study is being done and why your child is being invited to participate. It will also describe what your child will be asked to do to participate and any known risks, inconveniences or discomforts that your child may have while participating. We encourage you to take some time to think this over and to discuss it with your child, other family members, and friends. We also encourage you to ask questions now and at any time. If you decide to participate, you will be asked to sign this form, your child will be asked to sign the form, and it will be a record of your permission to allow your child to participate. You will be given a copy of this form.

### Why is this study being done?

The purpose of this research study is to determine whether a yoga videotape called "Yoga Fitness for Kids" can improve levels of attention in students who are diagnosed with ADHD. ADHD impacts approximately 5% of children and has many negative effects on school behaviors, particularly those related to paying attention during class. It is important for students to develop skills and strategies that will help them focus in the classroom. Yoga interventions have demonstrated promising results in this area. The Yoga Fitness for Kids videotape in particular has been shown to increase the percentage of on-task behaviors for students who struggle to pay attention. This study examines whether the Yoga Fitness for Kids videotape can increase the percentage of on-task behaviors for students who are diagnosed with ADHD.

### What are the study procedures? What will my child be asked to do?

If you give permission for your child to take part in this study, his/her on-task behaviors during typical classroom activities will be measured. At certain points during the study a data collector will observe your child for 15-minutes and measure the percentage of intervals that he/she is on-task. This procedure will not interrupt your child's typical learning in the classroom, and data collectors will not interact with your child in this setting. Your child may be observed between 13 and 17 times total throughout the experiment.

The study will begin with a screening phase, in which researchers will determine whether your child is demonstrating on-task behaviors in the classroom that could be improved by the Yoga Fitness for Kids intervention. During this phase, your child will be observed in his/her classroom 3 separate times across 15-minute sessions. After these observations you will be notified whether your child has been selected to participate in the study. Your child will not be selected to participate in the study if a) the researchers determine that his/her behaviors do not appear to warrant this intervention at this time or b) there was a higher number of participants screening into the study than anticipated. If he/she is selected you will be contacted and the study will begin immediately; if he/she is not selected you will be notified one final time informing you of this information, at which point you and your child will receive no further contact from the researchers.

Once the screening phase is completed and you are notified, your child's participation in the study will begin. He/she will be observed in his/her typical classroom setting an average of every other day. At some point in the study, your child will be asked to view a 23-minute Yoga Fitness for Kids videotape in the beginning of the school day. Your child will be asked to accompany a data collector to a quiet room in the school where they will follow along with the videotape and complete activities such as practicing yoga poses, practicing breathing, and practicing his/her ability to relax. It will be expected that your child is dressed in comfortable, athletic clothing that will allow him/her to be able to move around. You will be notified in advance of the days that the intervention will be delivered to your child, and the researchers ask that your child either come to school in athletic clothing or bring a change of athletic clothing that they can change in to prior to the beginning of the intervention. The intervention chosen for this study will be conducted individually, and your child will view the videotape alone. He/she will be provided with a yoga mat free of charge that will be disinfected with antibacterial wipes both before and after it is used. Mats will be used to complete the intervention, but participants are not permitted to keep the yoga mats once the intervention ends. The intervention will be delivered during non-academic time so that your child will not miss any schoolwork. Once your child begins viewing the videotape he/she will do so an average of two times per week until the study ends. They may end up viewing the videotape anywhere from 5 to 8 times throughout the study.

All of the research will take place in your child's school. The research will be conducted during his/her typical school day. The videotape will require approximately 27-minutes of your child's time per session once they begin viewing the Yoga Fitness for Kids videotape; the videotape itself lasts for 23-minutes, and the researchers estimate that an additional 4-minutes may be necessary for set-up time, time to walk to and from the room in which the intervention will be delivered, and the possibility that your child may need to change into athletic clothing. This will result in anywhere from 2.25 to 3.5 hours of time across the 5 to 6 weeks that the study will take to complete. You may view an excerpt from the intervention at [https://www.youtube.com/watch?v=-I\\_TB\\_N7nE0](https://www.youtube.com/watch?v=-I_TB_N7nE0). If you would like to view the intervention in

its entirety please contact the researchers and arrangements will be made for you to view it in your child's school. You will be notified if the intervention is having negative effects on the amount of time that your child is on-task in the classroom, at which point you will be given the option of removing your child from the study or allowing them to continue with the intervention phase. You and your child will not be contacted in the future. Your child will not be audio or videotaped.

Your child will be read an assent script that will explain to them the study in language that he/she can understand. He/she will be asked to sign this permission form, which will serve as his/her assent to participate in the study. If you would like a copy of the assent script that will be read to your child one will be provided to you.

The entire videotape will be viewed an average of two times per week, and your child will not be given breaks while it was playing unless there is an emergency, or if your child asks for a break or asks to stop. Your child will not be forced to view the videotape against their will. You will not be allowed to participate in the intervention with your child during the study.

If your child's medication changes at any point in the study we ask that you please contact the researchers immediately and alert them of the change. This is for research purposes only, as changes in your child's medication could explain changes in patterns in the researchers' observations. This information will not be shared with anyone, including school officials and teachers. If you do not notify the researchers it will be assumed that your child maintained his/her original type(s) and dosage(s) of medication for the duration of the study.

### What are the risks or inconveniences of the study?

Risks to your child are minimal. Although yoga does not involve contact with others and mostly involves standing or sitting in certain positions, there is a small chance that your child could feel physically uncomfortable while completing the yoga exercises. In order to minimize this risk, before the videotape begins playing one of the researchers will remind your child not to move in any way that will make him/her uncomfortable. If your child is injured at any point during the intervention you will be notified immediately, and your child will not continue with the intervention until he/she heals, and permission is given by you and your child to proceed. Additionally, the researchers will make sure that the videotape will be viewed in a well-lit room that will have plenty of space for your child to complete the yoga movements.

While your child's ADHD diagnosis will not be shared with anyone, it is possible that your child's classmates will recognize that your child leaves the room for 27-minutes each day. The researchers will make sure that your son/daughter is taken from the classroom in a way that will draw as little attention to him/her as possible. If one of your child's classmates asks the researcher why your child is leaving the classroom they will be told that your child is helping the researcher complete a project for school.

While your child will never miss required schoolwork, he/she will be taken from their classroom at certain points during the study to view the yoga videotape. A possible inconvenience to your child may be the time it takes to complete the yoga videotape. Previous research has shown that

children who have complete yoga in school have enjoyed it and did not mind completing yoga poses, practicing breathing, and practicing relaxation; however, it is possible that your child will feel differently. It is okay if your child cannot complete all of the yoga poses; however your child may feel frustrated or disappointed if they struggle during the intervention. If this occurs they will be reminded to do their best and will be encouraged to keep trying. Additionally, while previous research has shown that completing yoga interventions can help increase focus and attention, it is possible that the Yoga Fitness for Kids videotape will not increase your child's ability to pay attention in class.

### What are the benefits of the study?

By participating in this study, it is reasonably expected that your child will improve the percentage of time intervals that he/she is on-task during class time, while also improving his/her abilities related to yoga, relaxation, attention, and concentration. Their participation in this study could help advance researchers' knowledge about acceptable ADHD interventions. Depending on the results of the study, your child's participation could result in support for a yoga intervention as a way to improve the percentage of time intervals on-task for students diagnosed with ADHD.

### Will my child receive payment for participation? Are there costs to participate?

Your child will not be paid to participate in this study. There are no costs to you and your child for participating in this study.

### How will my child's information be protected?

The following procedures will be used to protect the confidentiality of the data collected from your child. The researchers will keep all study records (including any codes to your child's data) locked in a filing cabinet in a secure location. Research records will be labeled with a code. The code will be derived by assigning your child a random letter from A through F, followed by a random number ranging from 1 to 6. A master key that links names and codes will be maintained in a separate and secure location. The master key will be destroyed after 3 years.

All electronic files (e.g., databases, spreadsheets, etc.) containing identifiable information will be password protected. Any computer hosting such files will also have password protection to prevent access by unauthorized users. Only the members of the research staff will have access to the passwords. Data will not be shared with anyone, including school officials and teachers. At the conclusion of this study, the researchers may publish their findings. Information will be presented in summary format and your child will not be identified in any publications or presentations. De-identified data will be retained indefinitely.

We will do our best to protect the confidentiality of the information we gather from your child but we cannot guarantee 100% confidentiality. You should also know that the UConn Institutional Review Board (IRB) and Research Compliance Services may inspect study records as part of its auditing program, but these reviews will only focus on the researchers and not on your child's

responses or involvement. The IRB is a group of people who review research studies to protect the rights and welfare of research participants.

### What happens if my child is injured or sick because he/she took part in the study?

In the event your child becomes sick or injured during the course of the research study, immediately notify the principal investigator or a member of the research team. If your child requires medical care for such sickness or injury, your child's care will be billed to you or to your insurance company in the same manner as your child's other medical needs are addressed. However, if you believe that your child's illness or injury directly resulted from the research procedures of this study, you may be eligible to file a claim on behalf of your child with the State of Connecticut Office of Claims Commissioner. For a description of this process, contact Research Compliance Services at the University of Connecticut at 860-486-8802.

### Can my child stop being in the study and what are my and my child's rights?

Your child does not have to be in this study if you do not want him/her to participate. If you give permission for your child to be in the study, but later change your mind, you may withdraw your child at any time. There are no penalties or consequences of any kind if you decide that you do not want your child to participate. Your child may be withdrawn from the study if he/she refuses to complete the intervention on more than one occasion. You will be notified of all significant new findings during the course of the study that may affect your willingness to allow your child to continue.

### Whom do I contact if I have questions about the study?

Take as long as you like before you make a decision. We will be happy to answer any question you have about this study. If you have further questions about this study or if you have a research-related problem, you may contact the principal investigator, Dr. Tom Kehle at (860) 486-0166 or the student researcher Andrew Petsche at (518) 229-1692. If you have any questions concerning your child's rights as a research participant, you may contact the University of Connecticut Institutional Review Board (IRB) at 860-486-8802.

# Parental Permission Form for Participation in a Research Study



## Return Slip

**Principal Investigator:** Dr. Thomas Kehle

**Student Researcher:** Andrew Petsche

**Study Title:** The Effect of Yoga on Attention in Students Diagnosed with ADHD

### Documentation of Permission:

I have read this form and decided that I will give permission for my child to participate in the study described above. Its general purposes, the particulars of my child's involvement and possible risks and inconveniences have been explained to my satisfaction. I understand that I can withdraw my child at any time. My signature also indicates that I have received a copy of this parental permission form. Please return this form to the child's teacher by *(insert date)*.

\_\_\_\_\_  
Child Signature:

\_\_\_\_\_  
Print Name:

\_\_\_\_\_  
Date:

\_\_\_\_\_  
Parent/Guardian Signature:

\_\_\_\_\_  
Print Name:

\_\_\_\_\_  
Date:

Relationship to Child (e.g. mother, father, guardian): \_\_\_\_\_

\_\_\_\_\_  
Signature of Person  
Obtaining Consent

\_\_\_\_\_  
Print Name:

\_\_\_\_\_  
Date:

## Appendix B

### Child Assent Script

Principal Investigator: Dr. Thomas Kehle

Student Investigator: Andrew Petsche

Project Title: The Effect of Yoga on Attention in Students Diagnosed with ADHD

Hi *[student's name]*. I am Andrew Petsche and I am a student at the University of Connecticut. Right now, I am trying to learn about yoga and how it can improve your ability to pay attention in class. I would like to ask you to help me by being in a study, but before I do, I want to explain what will happen if you decide to help me.

I will ask you to come see me some mornings in *[room where intervention will take place]*. Once you get there, I will play a yoga videotape for you. On the videotape, you will see a woman who will ask you to practice yoga poses, practice your breathing, and practice your ability to relax. I will ask you to follow along with the videotape and listen to the directions that the woman gives you. Most importantly, I want you to have fun. By being in the study you will help me understand whether yoga can help improve your ability to pay attention in class.

You may miss a little bit of class time when you watch the yoga videotape, but I will do my best to make sure that you miss as little time as possible. You will never miss anything important. After watching the yoga videotape with me, you may find it easier to pay attention in class and concentrate, and you may become more flexible and better at yoga.

When I tell other people about my study, I will not use your name, and no one will be able to tell who I am talking about.

Your *[mom/dad/guardian]* says it is okay for you to be in my study. But if you do not want to be in the study, you do not have to be. I will not be upset, and no one else will be upset if you do not want to be in the study. If you want to be in the study now but change your mind later, that is okay. You can stop at any time. If there is anything that you do not understand you should tell me so that I can explain it to you.

You can ask me questions about the study. If you have a question later that you do not think of now, you can ask your parents or your teacher to call me or send me an email.

Do you have any questions for me now?

Would you like to be in my study and watch this yoga videotape?

**Name of Child:** \_\_\_\_\_

**Parental Permission on File:**     Yes         No *(If "No," do not proceed with assent or research procedures)*

**Child's Voluntary Response to Participation:**         Yes         No

**Signature of Researcher:** \_\_\_\_\_ **Date:** \_\_\_\_\_

Appendix C

Parental Notification Form



Principal Investigator: Dr. Thomas Kehle

Student Investigator: Andrew Petsche

Project Title: The Effect of Yoga on Attention in Students Diagnosed with ADHD

Hi *[parent/guardian name]*,

Thank you for giving permission for your child to participate in our research study. After completing the screening phase of the study it has been determined that:

\_\_\_\_\_ Your child has met the screening criterion for participation in the research study. This notification form is being sent to you to inform you that your child will begin the study procedures starting on *[insert date]*.

\_\_\_\_\_ Your child has not met the screening criterion for participation in the research study. This notification form is being sent to you to inform you that your child will no longer be participating in the study.

\_\_\_\_\_ Your child has met the screening criterion for participation in the research study; however a higher number of students have screened into the study than we have anticipated, and your child has not been randomly selected to participate. This notification form is being sent to you to inform you that your child will no longer be participating in the study.

If you have further questions at this point, you may contact the student researcher, Andrew Petsche at (518) 229-1692 or [andrew.petsche@uconn.edu](mailto:andrew.petsche@uconn.edu), or the principal investigator, Dr. Tom Kehle at (860) 486-0166 or [thomas.kehle@uconn.edu](mailto:thomas.kehle@uconn.edu).

Thank you for your time,  
-Andrew Petsche & Dr. Tom Kehle

## Appendix D

### Direct Observation Data Collection Sheet

Observer Name: \_\_\_\_\_ Date: \_\_\_\_\_

Subject: \_\_\_\_\_ Activity: \_\_\_\_\_

Time observation began: \_\_\_\_\_

Is this an IOA Observation (circle one): YES / NO

**On-task behavior:** any behavior in which a student is actively or passively participating in class.

**Examples:** writing; reading aloud; raising a hand; talking to the teacher about the assigned material; talking to a peer about the assigned material; listening to a lecture; looking at an academic worksheet; reading assigned material silently; looking at the blackboard during teacher instruction; or listening to a peer respond to a question\*

**Nonexamples:** talking about nonacademic material; calling out; aimlessly flipping the pages of a book...aimlessly looking around the classroom, silently reading unassigned material; and any other form of off-task behavior\*

Time	:10	:20	:30	:40	:50	1:00	1:10	1:20	1:30	1:40	1:50	2:00	2:10	2:20	2:30
ON-TASK															

Time	2:40	2:50	3:00	3:10	3:20	3:30	3:40	3:50	4:00	4:10	4:20	4:30	4:40	4:50	5:00
ON-TASK															

Time	5:10	5:20	5:30	5:40	5:50	6:00	6:10	6:20	6:30	6:40	6:50	7:00	7:10	7:20	7:30
ON-TASK															

Time	7:40	7:50	8:00	8:10	8:20	8:30	8:40	8:50	9:00	9:10	9:20	9:30	9:40	9:50	10:00
ON-TASK															

Time	10:10	10:20	10:30	10:40	10:50	11:00	11:10	11:20	11:30	11:40	11:50	12:00	12:10	12:20	12:30
ON-TASK															

Time	12:40	12:50	13:00	13:10	13:20	13:30	13:40	13:50	14:00	14:10	14:20	14:30	14:40	14:50	15:00
ON-TASK															

Time	15:10	15:20	15:30	15:40	15:50	16:00	16:10	16:20	16:30	16:40	16:50	17:00	17:10	17:20	17:30
ON-TASK															

Time	17:40	17:50	18:00	18:10	18:20	18:30	18:40	18:50	19:00	19:10	19:20	19:30	19:40	19:50	20:00
ON-TASK															

<b>Number of Intervals in which on-task behavior is observed</b>	
<b>Total number of intervals observed</b>	
<b>Percentage of intervals on-task</b>	
<b>IOA Only: Total Number of Agreements</b>	
<b>IOA Only: Percentage of Agreement</b>	

\*Operational definition of examples and nonexamples derived from Shapiro, E. S. (2011). Academic skills problems: Workbook (4th ed.). New York, NY, US: Guilford Press.

Appendix E

Treatment Integrity Questionnaire

Observer Name: \_\_\_\_\_ Date: \_\_\_\_\_

**Please circle your answer to the questions below.**

1. *Were all of the necessary participants who were present in school today present for the intervention?*

**YES**

**NO**

2. *Were the participants that were present for the intervention wearing appropriate clothing to participate in the intervention (i.e., clothes that allowed them to move around comfortably)?*

**YES**

**NO**

3. *Was the Yoga Fitness for Kids videotape run in its entirety without video or audio malfunctions?*

**YES**

**NO**

4. *Did the participants participate in the intervention by following along with the directions given by the instructor in the videotape to the best of their abilities?*

**YES**

**NO**